DISCOVERY

The effect of different treatments on Carob (*Ceratonia siliqua* L.) seed germination

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ABSTRACT

This study deals with the germination of carob (*Ceratonia siliqua* L.) seeds by using different treatments such as, distilled water, different degrees of temperature, boiling distilled water and different sulphuric acid concentrations. Carob seeds soaked in distilled water for 4 days gave a percentage of germination 11.6%. Temperature at (5°C) decreased the percentage of germination to (5.7%) at light. However, gradual increase in temperature 15, 20, 25, 30 & 35°C increased the percentage of germination into 60%, 65%, 75%, 78% and 88% respectively, since high temperature aid in breaking dawn the seed coat which in turn permits flow of water and gases into seed embryo. Carob seeds were also treated with boiled water (100°C) for one complete day and the percentage of germination obtained was 82%. However, carob seeds treated with different concentration of Sulphuric acid (30%, 40%, 50%, 60%, 70%, 80%, 90-98%), in order to break dawn, the hard seed coat. The results showed that treatment with 98% concentration of Sulphuric acid (H2SO4) affected the viability of the embryo and no germination was observed whereas, treatment with 70% concentration increased the percentage of germination to 95%.

Keywords: Carob, seed germination, distilled water, temperature, boiling water, sulphuric acid.

1. INTRODUCTION

Ceratonia siliqua L. is a tree, up to 15-20 m tall, evergreen; dioecious belonging to the family Caesalpiniaceae. This species is probably indigenous in Jable Akhdar area and cultivated elsewhere in Libya (Jafri, 1978). Carob tree is widely cultivated in Mediterranean area such as Cyprus, Greece, Italy, Spain, Syria, Turkey, Egypt, Tunisia, Libya and Morocco (Jafri, 1978). Carob species characterized by having hard seed coat impermeable to water and oxygen. Moreover, the hard and impermeable seed coat considered as the main cause of cacoatrob seed dormancy, which represent another factor that prohibit seed germination (Bidwell, 1974). Since carob seed coats are impermeable to water and oxygen, then seeds will not germinate without breaking dawn the seed coat (Bostan and Kilic, 2014; Piptto and Piccini, 1996; Piptto and Ciccarese, 1999; Piptto and Di-Noi, 2003).

In this study, treatment with distilled water, temperature, boiling water and sulphuric acid were used to enhance germination of carob seeds. Moreover, hard

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seed coat that prevents absorption of water and flow of gases causing retarding to the growth of the embryo (Devlin and Witham, 1983). The steps of germination commence with uptake of water and oxygen and ends up with rupture of seed coat and emergence of radicle. Seed germination is determined by observing protrusion of the radicle from seed coat (Devlin and Witham, 1983).

Water is the most important factor for seed germination since activity of metabolism, takes place only in high supply of water (Bidwell, 1974). Oxygen on the other hand is an important factor for seed germination since most of seeds depend on aerobic respiration for their germination, therefore, as the percentage of aerobic respiration increases, the percentage of germination increases and when the oxygen supply is increased, it brings about an immediate and rapid increase in the percentage of oxygen absorption, at the same time, the increased oxygen supply brings an immediate germination of the seeds (Shull, 1914).

The effect of temperature on seed germination varies between plant species and the alternation of temperature gives maximum germination (Devlin and Witham, 1983). In addition to that, seeds vary in their response to light, where some seeds require light for germination and other seeds failed to germinate when exposed to light. Failure of seeds to germinate is due to immature embryo; therefore, Germination will occur only when the embryo development is complete (Shull, 1914; Devli and Witham, 1983). The purpose of this study is to determine the percentage of carob seed germination by using different treatments.

2. MATERIALS AND METHODS

Carob ripe pods with mature seeds were collected in 2022 from cultivated tree at the agriculture research station/faculty of Agriculture/Tripoli university- Libya. Collected seeds were cleaned and stored at room temperature (25 -30°C) for one week. To test seed viability, seeds were soaked in water those float up were discarded. Seeds were then placed in 10 sterilized petri dishes with 5ml. of distilled water each. Fifteen carob seeds were put in each petri dish lined with one Whitman paper No1. In this experiment, carob seeds treated with distilled water, different degrees of temperature, boiling distilled water and different concentration of sulphuric acid (H2SO4) in order to break hard seed coat of carob seeds and allow water and gases to pass through. For distilled water treatment, seeds were soaked in distilled water at room temperature (25-30°C) for 4 days.

To test the effect of temperature on the percentage of germination, carob seeds (in petri dishes) were incubated at different degrees of temperature 5, 15, 20, 25, 30 and 35°C. As for treatment with boiling water, seeds were soaked in boiling water (100°C) for one complete day. Carob seeds were also treated with different concentrations of sulphuric acid 30%, 40%, 50%, 60%, 70%, 80%, 90% and 98%. In this treatment, five seeds of Carob were soaked in each concentration of sulphuric acid for 8-15 minutes; eventually seeds were washed with running water for approximately40 minutes to get rid of any traces of sulphuric acid. Germinated seeds counted daily.

3. RESULTS AND DISCUSSION

This study concerns with the germination of carob seeds by using different treatments include distilled water, different degrees of temperature, boiling distilled water and different concentrations of sulphuric acid. Results of this study showed that the percentage of germination for carob seeds treated with distilled water was 11.6%. Whereas, the percentage of germination for carob seeds treated with boiling distilled water was (100°C) was 82% (Figure 1).

The results also showed that, the percentage of germination at 5°C was too low 6.7%, but as temperature rises up 15, 20, 25, 30 and 35°C the percentage of germination increases spontaneously, since high temperature aids in breaking hard seed coat of carob seeds and permits the flow of water and gases through. Moreover, the results revealed that the percentage of germination at 35°C was 88%, according to that, temperature at 35°C is considered ideal for the germination of carob seeds (Figure 2).

In addition to that, the results of this study revealed that, the percentage of germination of carob seeds treated with different concentrations of Sulphuric acid 30%, 40%, 50%, 60%, 70%, 80%, 90% and 98% was 15%, 35%, 60%, 80%, 95%, 10%, 5% and 0% respectively. The results showed that, treating the carob seeds with of 98% concentration of H2SO4 for 8-15 minutes affected the viability of the embryo and bring the germination to 0%. Whereas, treating the seeds with 70% concentration of H2S0O4 for the same period was an ideal concentration that breaks hard seed coat without affecting embryo viability therefore, permits water and gases to pass through and increases the percentage of germination to 95% (Figure 3).

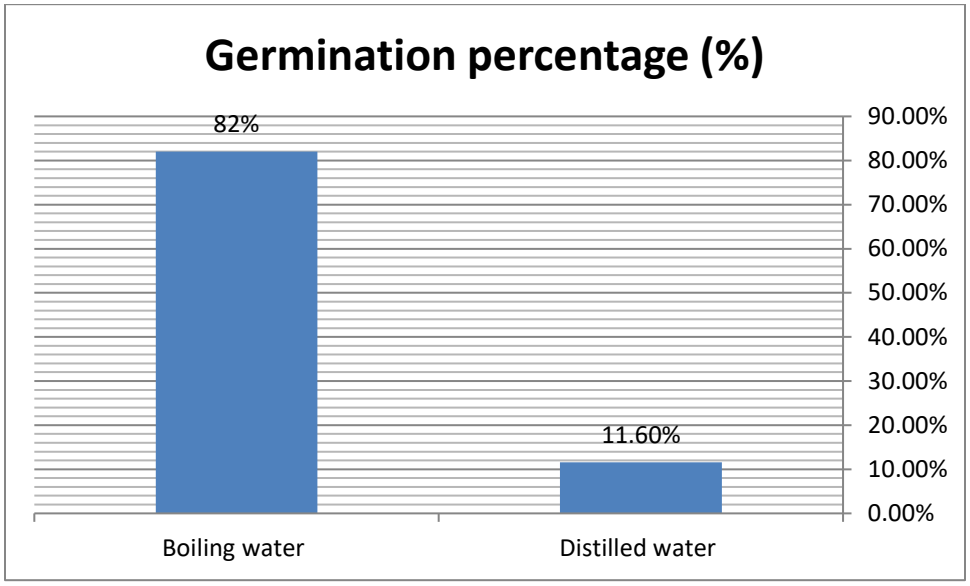

Figure 1 Percentage of carob seed germination at distilled water and boiling water

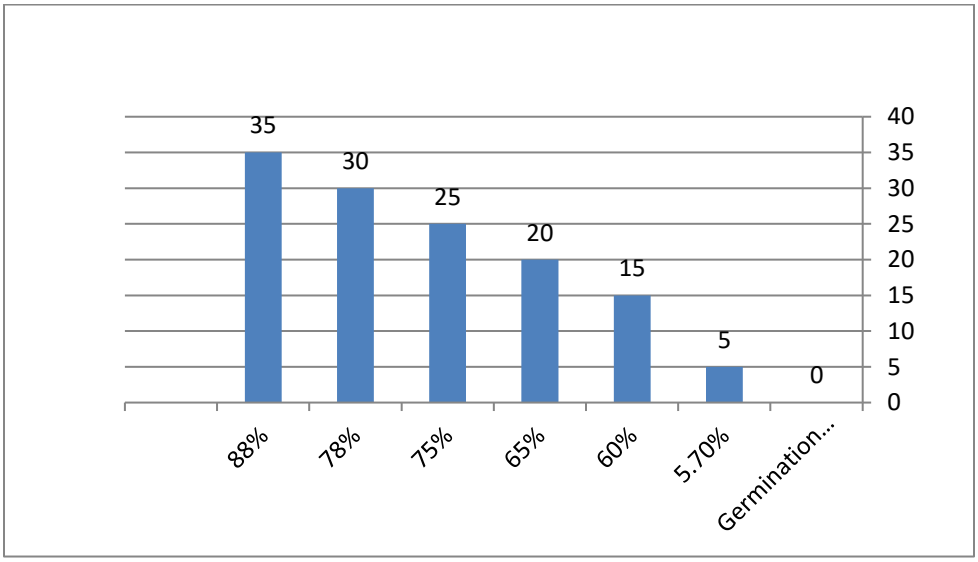

Figure 2 Percentage of germination at different degrees of temperatures

Based on the results of this study, hard seed coat and low temperature retard germination of carob seeds. Whereas, high temperature 30-35°C aids in breaking hard seed coat and permit the passage of water and gases through, consequently increases the rat of germination. Treatment with distilled water brings the percentage of germination to 11.6% whereas, carob seeds immersed in boiling water (100°C) for one complete day bring the percentage of germination to 82% (Figure 1).

Treatment with 90-98% concentration of H2SO4 affected the viability of the embryo, therefore the percentage of germination declines to 0%. Whereas, treatment with 70% concentration at 30-35°C increases the percentage of germination to 95%, since 70% concentration breaks dawn the hard seed coat of carob and allows passage of water and gases through easily without affecting the viability of the embryo.

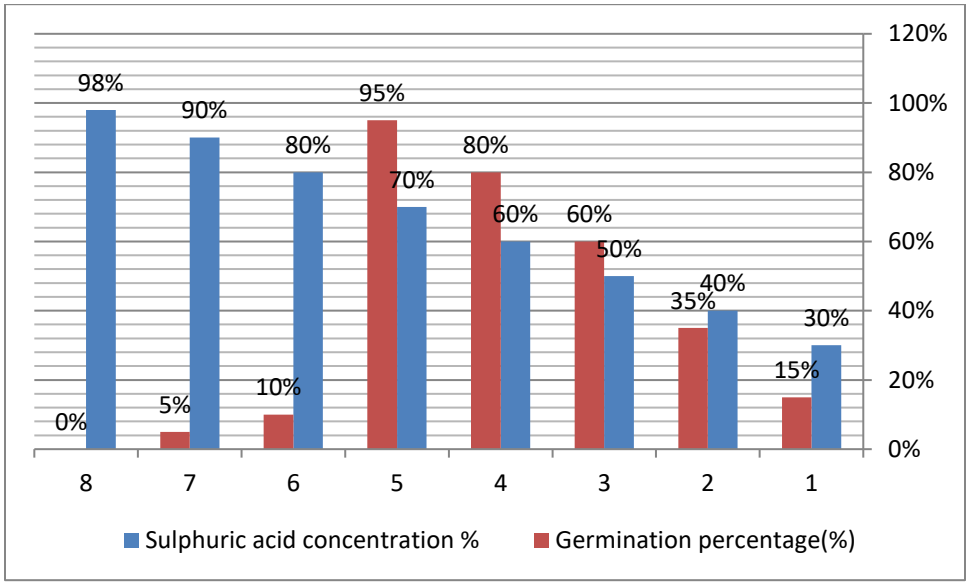

Figure 3 Percentage of germination at different concentration of H2SO4 at 30-35°C

4. CONCLUSION

Carob seeds are characterized in having hard seed coat that prohibits passage of water and oxygen through. Different treatments were used in this study to break the hard seed coat and allow water and O2 to pass into the embryo to enhance germination. The treatments used include distilled water, different degrees of temperature, boiling water and different concentration of sulphuric acid. The results of this study showed that boiling distilled water, temperature at 30-35°C and 70% concentration of sulphuric acid gave very good and engorging results 82%, 88% and 95% percentage of germination. According to that, the percentage of germination of carob seeds can be obtained easily by treating them with boiling distilled water, temperature at 30-35°C and 70% concentration of sulphuric acid.

Informed consent

Not applicable.

Ethical approval

The ethical guidelines for plants & plant materials are followed in the study.

Conflicts of interests

The authors declare that there are no conflicts of interests.

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The study has not received any external funding.

Data and materials availability

All data associated with this study are present in the paper.

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